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EDT 514

**Learning Activity 2**

* **Lesson Title**
  + Factor a Polynomial in the form x2+bx+c
* **Short Description of Lesson**
  + Students will learn how to factor a polynomial of the form x2+bx+c. This is the first they are seeing this concept and the essential foundation for further factoring. Therefore, they will practice this skill at great length, in different group sizes and I will assess them in various ways. After I feel this concept is mastered, they will take a quiz to assure that we can successful move on to the next concept. We will be learning two methods and the students will be able to choose with method they prefer on their homework and the quiz.
* **Classroom Layout and Grouping of Students**
  + The classroom is set up in groups of four. This is most conducive to the three main ways the students will be working; in pairs, in groups of four, and on their own. The groups will be arranged so that no student has their back to the Smart Board, which is the main tool I will be using to guide my instruction. Also, the groups are arranged so that each group has various levels of achievement within it (no group will have all A students or all failing students). For this lesson, each student will have paper, a pencil, and a graphing calculator and each group will get one Mobi device.
* **Students’ Present Level of Performance and Skills**
  + The students have worked with the concept of factoring in the previous lesson, during which they factors out a greatest common monomial from a polynomial. This will have laid the groundwork for factoring trinomials with a leading coefficient of one. They have used the graphing calculators, Mobi Devices, and the CPS controllers in the past, as well, so we will not need to spend too much time reviewing how to use them.
* **Instructional Objectives**
  + Students will be able to factor a trinomial with a leading coefficient of one by using either the table method or “bottoms up” method.
  + Students will solve an equation by factoring using one of the listed methods.
  + Students will begin to see how a polynomial forms a parabola using their calculators.
  + Students will be able to complete an assessment over the material learned in this lesson.
* **Grade Level Content Expectations**
  + **A1.1.3** Factor algebraic expressions using, for example, greatest common factor, grouping, and the special product identities.
  + **A1.1.4** Add, subtract, multiply, and simplify polynomials and rational expressions.
  + **A1.2.1** Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.
* **METS-S: Michigan Education Technology Standards for Students**
  + **9-12.TC.2**. Use an online tutorial and discuss the benefits and disadvantages of this method of learning
  + **9-12.CT.1.** Use digital resources (e.g., educational software, simulations, models) for problem solving and independentlearning
  + **9-12.TC.5.** identify an example of an assistive technology and describe its potential purpose and use
* **Materials, Resources, and Technology**
  + Smart Board
  + Smart Board activities from exchanges.smarttech.com
  + CPS Controllers
  + Mobi Devices
  + Online tutorial from Khanacademy.org
    - <http://www.khanacademy.org/video/factoring-trinomials-with-a-leading-1-coefficient?topic=core-algebra>
  + Online tutorial from Brightstorm.com
    - <http://brightstorm.com/math/algebra/factoring-2/factoring-trinomials-a-equals-1/>
  + McDougal Little Algebra 1 textbook
  + Paper
  + Pencils
  + Graphing Calculators
* **Instructional Procedures**
  + **Day 1:** The class will begin with the students doing the warm up problem, “Factor x2+6x” that will be on the Smart Board as they enter. After several minutes a student will be randomly chosen to come up and do the problem on the board. After this we will begin our notes. Next, the class will go over the homework from the night before. Each group will be expected to complete several of the homework problems on the Smart Board using their Mobi device. This will allow for any uncertainties about the homework to be addressed. Once the checking of the homework is done they will turn their work in to be checked and graded by the teacher later. After this we will begin our new lesson by watching the Khan Academy and Bright Storm videos the Smart Board. Once this video is over the teacher will begin giving notes on the Smart Board on the table method for factoring a trinomial and solving a polynomial equation. The teacher will work through several examples on the board and address any questions the class has. Next, the students will work with the other 3 people at their table to each complete one problem, given to each of them by the teacher, for the group. The student will walk around to address any questions and to listen in on the students’ explanations to one another on how to solve the problem. After roughly ten minutes, the average time for a task like this to be completed, the teacher will refocus the students on herself to discuss what they had just done. Once this is done the students will be given a one problem “ticket out the door” using their CPS controllers. The problem “Factor and solve: x2+7x+10=0” will be given to them and they will submit their factored equation and the solution using their CPS controllers. Once everyone has submitted an answer and the results are discussed, students will be given the rest of the class period (which would appear to be a max of 10 minutes) to begin their homework assignment from the textbook that will be due the following class period.
  + **Day 2:** Upon entering class, students will be expected to complete the warm-up problem “Factor x2+11x+18.” After several minutes a students will be randomly chosen to complete the problem on the Smart Board and then the class will check the homework from the night before in the same fashion as the day before. Once all questions have been addressed and all work has been handed in to be checked, the students will be asked to get out their graphing calculators. The class will discuss how that, in math, there are many ways to solve a problem and get to the same answer. The students will be asked to think of scenarios when that has been the case this school year during the discussion and each group will submit an example on the Smart Board using their Mobi devices. This will lead into the lesson for the day about how there is more than one way to factor a trinomials they have been working with. The students will take notes on how to use the “bottoms up” method to factor. After taking notes while the teacher does several examples on the boards. The students will complete two problems with their partner using the new method. After several minutes the teacher will bring the focus on the students back up to the board to answer any questions she was unable to answer while the students worked. Following this, the students will learn another way to solve for the polynomial. The teacher will model for the students, using the graphing calculator on the Smart Board, how to put their polynomial into the graphing calculator and use the graph that occurs to solve the polynomial. After this the students are given their homework assignment, a worksheet. The students are allowed to use the method of their choice, the table method or bottoms up, to factor the trinomial and to solve the equation; they are encouraged to use the graphing calculator to check their answers.
  + **Day 3:** Class will begin with the warm-up problem, “Factor and Solve: x2-3x-28.” After several minutes, a student will be randomly selected to solve the problem on the Smart Board. Following this, the class will check the homework from the night before in the same fashion they have the other two days. After the assignments are turned in, the students will be taking a quiz on the concepts covered in Lesson 1 and 2 of the unit. After completing the quiz, the students will use the rest of the hour to write a brief, one paragraph explanation of which method they prefer to use for factoring and why. If the paragraph is not able to be completed in class, the students are to finish it as homework.
* **Supplemental Activities: Extensions and Remediation** 
  + Every day the students will have a warm-up problem on the board for them when they enter class. The first day’s warm-up is to factor a greatest common monomial out of a polynomial, the second and third day the problem instructed the students to factor and solve a polynomial. Also, every day students will have homework assignments that they are to begin in class, so they can hopefully clear up any confusion they are having with the concept, and they are expected to finish before returning to class the next day. The first night the homework assignment will be an assignment from their text book so they can use their book as a reference if needed. The second day the homework assignment will be a worksheet and the third night they are to finish their paragraph about factoring.
* **Assessment**
  + Formal assessments include the homework that is turned in daily, the quiz at the end of the lesson, and the test that will be given at the end of the unit.
  + Informal assessments include the CPS mini quiz and the discussion/group work time conducted during class.
* **Student Products**
  + The student products include 2 homework assignments, a quiz, and a written response about which method they prefer and why.

**TPACK Analysis**

* **Content:** Understand how to factor and solve a trinomial with a leading coefficient of one.
* **Pedagogy:** 
  + Direct Instruction is used when initial teaching the students the new concepts and when explaining the assignments. This allows for the students to get the correct information and to gain initial understanding.
  + Cooperative Learning Groups is used to delve deeper into the content while completing the in class activities. It also allows for the students who are having difficulties with the concept to gain help from a peer.
  + Class Discussions is used to encourage higher level thinking and provide different insight and opinions on the concepts.
  + Independent Work is used to ensure the student is getting practice with the concept and has a good grasp on the material.
* **Technology:** 
  + A Smart Board is used to present information to the students and allow them to share information with one another.
  + Online tutorial videos from Khanacademy.org and Brightstorm.com are presented on the Smart Board to aid in the students learning of the new content and offer than a resource to use as a study tool.
  + Graphing Calculators are used to help with checking the solutions they find after factoring the polynomials.
  + Mobi devices are used by the groups to share their information with the class.
  + CPS controllers are used as an assessment tool.
* **Content Knowledge:**  The teacher has B.S. in Mathematics so they are very competent when it comes to the subject matter. This is also not the teachers first year teaching this content so they have worked with this lesson in the past.
* **Pedagogy Knowledge:** Many of the students struggle with math or do not enjoy the subject. It is the teacher’s responsibility to present the material in a meaningful way by providing real life applications and making it engaging through the use of technology, videos, and group work. This age group of students tends to feel successful when they are able to talk through problems with their peers which is why group work will be utilized a great deal. However, in order to gain a good understanding of mathematical concepts, practice and repetition are necessary, hence why daily homework assignments are given. Furthermore, by allowing students to choose with method they prefer to factor, they are able to feel some control in their learning experience and are, therefore, more likely to feel the accountability to completing the work.
* **Technology Knowledge:** The teacher is currently pursuing an Educational Technology Endorsement and has attended many after school training sessions on how to use all the technologies being used in this lesson. They are more than able to successfully utilize these resources.
* **Pedagogical Content Knowledge:** Many students find mathematics difficult and boring. In order to address these concerns, it is the educator’s responsibility to make the content engaging and to ensure that all students are able to feel success and have an understanding of the content. Allowing the students to make choices in the classroom allows them to feel partially responsible for their education and greatly improves their motivation in the classroom. Researcher Kohn (1993) wrote, “Many different fields of research have converged on the finding that it is desirable for people to experience a sense of control over their lives. These benefits reach into every corner of human existence, starting with our physical health and survival” and that “deprive them of self-determination (which spawns from making choices and you have likely deprived them of motivation.” The research in support of allowing the students to make choices in the classroom goes on and on. By allowing the students which method they wish to choose to solve the problems I am allowing them to feel that their opinions are valued and that they have a say in their learning process. Also, by allowing them to work in groups they are able to help one another with concepts they may not understand and they are more likely to view their learning experience as an enjoyable time because social interaction in involved.
* **Technological Content Knowledge:** Since technology is so ingrained in students’ everyday life, incorporating it into the classroom will help enhance their learning experience. This is especially true in mathematics. With the creation of things such as online tutorials and virtual manipulatives, the teaching of mathematics has been greatly enhances and the likelihood of more children comprehending the concepts has increased drastically. Gardner (2004) wrote, while reflecting on some of her staff members’ implementation of technology, that “By giving their students the opportunity to become actively engaged in their learning, my math teachers have moved away from daily practice drills and rote memorization to integrating technology into their math curriculum in order to investigate, evaluate, and analyze math concepts.” Gardner’s school has found great success in this and so would any school that chose to incorporate technology into their daily lessons. Technology allows students to engage in hands on activities, explore other explanations of a concept, and delve deeper into content which helps them to retain more knowledge and be more willing to participate in higher level thinking.
* **Technological Pedagogical Knowledge:** By implementing technology into this lesson, the students are more likely to be interested in this topic. Allowing them to work in groups and use devices like CPS controllers and Mobi devices, the students feel that they are active participants in the learning experience. When a task like coming up to the chalk board to write their homework answer is transformed into using a Mobi tablet to write it on the board from their desk, the students’ level of interest and willingness to participate increases drastically. Furthmore, where a “ticket out the door” used to be a battle, allowing them to submit their answer using a CPS controller and seeing immediate results makes it appear more like a game and provides them, and the teacher, with instant feedback on whether or not the days lesson was a success. Also, incorporating things like the online tutorials allows the students to see another “spin” on what the teacher is teaching and provides them with a resource they can use outside of the classroom if they need a “refresher” on the concept while working on homework or studying for their test. The graphing calculator acts in a similar way in this lesson. They are able to see yet another way to find the solutions for their polynomial and now have a great tool to check their work with. When students feel like their tasks are “made easier” they are more willing to do the work even if, in reality, they are still completing the steps they would have anyhow.
* **Technological Pedagogical Content Knowledge:** By incorporating all of these elements, it is likely that the students understanding of the concepts and enjoyment of the lesson will be greatly improved. By incorporating technology and various instructional methods while giving the students choices; more students are likely to find success during this lesson than if the teacher had stood in front of the class and lectured from a textbook and gave them very narrow constraints on their tasks. This lesson incorporates a great deal of differentiation. Therefore, all students should find a moment of success during this lesson. That one moment of success is all that is needed for the student to decide this concept isn’t “stupid” or a “waste of their time” and that will allow them to open up to it.

**References**

Gardner, Judy. "Technology + Planning + Math = Integration." *Knowledge Quest* 32.5 (2004): 26-9. *ProQuest Technology Collection.* Web. 10 Feb. 2012.

Kohn, Alfie. “Choices for Children: Why and How to Let Students Decide.” *Phi Delta Kappa* (1993): *Alfiekohn.com.* 15 Feb. 2012.